STUDY OF CLUSTER STRUCTURE OF EXOTIC 13B NUCLEI PRODUCED AT FRIBS FACILITY OF LNS – CATANIA

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The study of the nuclear clustering is one of the oldest and important subject in the field of the nuclear physics, since it reveals much about the nature of the force through which the nucleons interact and the resulting symmetries. The α-particle is one of the most highly bound cluster nuclei, but also heavier nuclei tend to optimize their own binding energy by generating internal clusters. This can lead to clustering in alpha shape as well in other possible exotic configurations, particularly favoured in light neutron rich systems, producing strongly deformed and easy to break up nuclei.
In this framework we are going to study the break-up of the Boron isotope ^{13}B, measuring the ccompetition between the different decay channels, related to different cluster states. Experiment will be realized at LNS with a beam of ^{13}B produced by the on line fragmentation system FRIBS and impinging on the hydrogen of a plastic (CH_2) target. Decay products of the ^{13}B will be measured with CHIMERA and FARCOS multi detector devices. Activity will concern experiment preparation and realization at LNS as well as following data analysis carried out also at the Dipartimento di Fisica e Astronomia.

MEASUREMENT OF NUCLEAR DENSITY IN HEAVY ION REACTION AT FERMI ENERGIES

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The research work aims at studying the nuclear reaction mechanisms in Heavy Ions collisions at Fermi energies. An important role in these studies is played by the gradient of the nuclear density affecting the isospin asymmetry of the reaction products. Experimental determination of the value of the nuclear density in the early phase of the collision between two heavy nuclei is a crucial step towards the understanding of the underlying mechanism responsible for the production of nuclear clusters of intermediate atomic number ($Z< 10$), that is still an unsolved problem. The experimental method consists in constructing kinetic energy correlations of couple of clusters and its comparisons with the most advanced nuclear transport theories.

EFFECTIVE INTERACTION AND DYNAMICS OF EQUILIBRATION PHENOMENA IN THE SYSTEM $^{48}CA+^{27}AL$ AT 40 MEV/NUCLEON

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The proposed thesis work starts with the analysis of the data collected for the 48Ca+27 Al at 40 MeV/nucleon collision recently performed in Catania at the LNS by using the 4π multi-detector CHIMERA.The aim of this study is to investigate on isospin equilibration processes in different reaction mechanisms. The charge, mass, velocity and multiplicity measurements of the produced fragments and the comparison with molecular dynamics approaches will allows to get information about the effective interaction describing the iso-vectorial force and at what extent it affects the spontaneous clustering process. By working on the collected data the student will have the opportunity to work on the most important and modern identification techniques associated to the charged particle detection (E-DE technique, time of flight, pulse-shaping analysis and related software) together with the fundamental criteria for the analysis of complex-multi-particles events.
Finally, the theoretical interpretation of the experimental results will allow the knowledge of one of the most sophisticated semi-classical approaches to the nuclear many-body problem.